Docket No.: 043888-0314 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 53080
Yuu INATOMI, et al.	:	Confirmation Number: 2569
Application No.: 10/827,424	:	Group Art Unit: 1795
Filed: April 20, 2004	:	Examiner: Chu, Helen Ok

For: ELECTROCHEMICAL DEVICE AND ELECTRODE ACTIVE MATERIAL FOR ELECTROCHEMICAL DEVICE

REPLY BRIEF

Mail Stop Reply Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 C.F.R. § 41.41, the following Remarks are respectfully submitted in response to the Examiner's Answer dated July 28, 2008. Appellant reasserts all arguments contained in the Principal Brief.

Status of Claims

1. Claims canceled: 1-19, 21, 56 and 58.

2. Claims withdrawn from consideration, but not canceled: 20, 23, 24, 26, 27, 29-31, 33, 34, 36, 37, 39, 40, 42, 43, 45, 46, 48, 49, 51, 52, 55 and 57.

3. Claims pending: 22, 25, 28, 32, 35, 38, 41, 44, 47, 50 and 53. Claim 32 is the sole independent claim pending and not withdrawn.

4. Claims allowed: None.

5. Claims rejected: 22, 25, 28, 32, 35, 38, 41, 44, 47, 50 and 53.

6. Claims on appeal: 22, 25, 28, 32, 35, 38, 41, 44, 47, 50 and 53.

Grounds of Rejection To Be Reviewed By Appeal

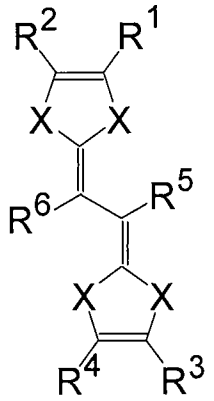
(1) Claims 22, 25, 28, 32, 35, 38, 41, 44, 47, 50 and 53 stand rejected under 35 U.S.C. § 103(a) for obviousness predicated upon Zhang et al. (USP No. 6,110,619) ("Zhang") in view of Carlier et al. (Publication Electrochimica Acta).

Argument

(1) Claim 32 is not obvious under 35 U.S.C. § 103(a) over Zhang in view of Carlier.

It is alleged in the Examiner's Answer that the combination of Zhang and Carlier discloses the limitations of the present invention. Applicants respectfully submit that this allegation is incorrect.

Independent claim 32 recites a secondary battery, comprising a positive electrode, a negative electrode and an electrolyte, wherein at least one of said positive electrode and said negative electrode includes an electrode active material comprising a compound having a structure represented by the general formula (1a):



where X is a sulfur atom or an oxygen atom; each of R^1 to R^4 is independently a linear or cyclic aliphatic group, a hydrogen atom, a hydroxyl group, a cyano group, an amino group, a nitro group or a nitroso group; each of R^5 and R^6 is independently a linear or cyclic aliphatic group, or a hydrogen atom; said aliphatic group includes at least one selected from the group consisting of an oxygen atom, a nitrogen atom, a sulfur atom, a silicon atom, a phosphorus atom, a boron atom, and a halogen atom.

As previously discussed, Zhang fails to teach the specific compound of formula 1(a). This deficiency is admitted in all previous Office Actions. Carlier is alleged to remedy this deficiency by disclosing a compound of formula 1(a). In addition, it was alleged that Zhang teaches that the positive electrode active material has an organo-sulfur structure. Thus, it is implied that Zhang suggests a compound of formula 1(a) could be used in a secondary battery.

The Examiner has relied upon a passage of Zhang cited in the Office Action (col. 2, line 52) to provide support for the disclosure of an "organo-sulfur" material for use in a positive electrode active material. It has been noted by the Applicants that the passage clearly states that "herein, the term 'organo-sulfur materials' means **a material containing organic sulfur compounds with only single or double carbon-sulfur or sulfur-sulfur bonds**". It was then argued by Applicants that as the compound of general formula 1(a) contains carbon-carbon bonds, then compound 1(a) does not fall into the category of organo-sulfur compounds *as defined in the Zhang reference*. In fact, nowhere in Zhang is there a mention of the use of a compound of formula 1(a), or a compound having carbon-carbon bonds as a positive electrode active material.

In response to the above-mentioned argument, the Examiner states that the Applicants are "misconstruing the disclosure". The Examiner alleges that the term "only" can be interpreted in that the compound can "only" consist of single or double bonds which excludes triple bonds. This allegation is demonstrably incorrect. Foremost, the Examiner provides no evidence of this interpretation other than merely saying so. However, more importantly, a carbon-sulfur or sulfur-sulfur triple bond **cannot exist in nature**! It would be pointless to, as the Examiner suggested, differentiate carbon-sulfur or sulfur-sulfur single and double bonds from triple bonds because every skilled artisan knows could such compound can never be formed in the first place.

As such, the Examiner's alleged interpretation of "only" as well as the definition of "organo-sulfur material" is clearly incorrect.

However, the Examiner does not stop there. The reference "Organic Chemistry" is used to support the statement that the term "organo" or "organic" is known in the art to mean "any compound with at least one carbon". Applicants do not disagree with the definition of these terms. It is indeed well-known in the art that organic compounds contain carbon. Nor are Applicants suggesting that the organo-sulfur materials disclosed in col. 2, line 52 of Zhang do not contain carbon. They in fact do. However, this is not the argument. Applicants have shown that Zhang **explicitly** defined the term "organo-sulfur material" to mean one having **only** single or double carbon-sulfur or sulfur-sulfur bonds. A ***carbon***-sulfur bond clearly contains carbon. However, since the explicit definition states that **only** carbon-sulfur and sulfur-sulfur bonds exist in the material, then carbon-carbon bonds are excluded. The reference could not be more clear about this. The term "only" means no exceptions, no deviations. Yet, the Examiner would have us believe that an organic chemistry text, which speaks generally about a vast range encompassing all organic compounds known in nature, somehow trumps the explicit and specific definition provided in the primary reference. The inventor would not have gone through the effort of defining the term "organo-sulfur material" if only a general term whose definition could be found in a text book was intended, or if a clarification of the definition was not necessary. Accordingly, the Examiner's suggestion that the Applicants misconstrued the disclosure of Zhang is incorrect.

The Examiner then alleges that Zhang "surely does not exclude compounds of carbon-carbon bonds, for an example, of the carbon cyclic repeating groups (col. 11, lines 15-20), carbon-carbon cyclic rings of col. 9, lines 40-50 and col. 4, lines 35-50". Here it is clear that the

Examiner is grasping at straws. Foremost, none of these passages are in reference to the "organo-sulfur materials" of col. 2, line 52. Each discuss a completely different set of compounds. The Examiner is attempting to combine the qualities of different compounds having completely different uses. Furthermore, no evidence is provided to show that these compounds suggest the use of the compound of general formula (1a). It appears that the Examiner is attempting to suggest that if the Zhang reference discloses any compound with a carbon-carbon bond anywhere in the reference, it is support that any organo-sulfur compound can be used in battery of Zhang. For example, the passages in col. 4, lines 35-50 and col. 9, lines 40-50 are the acid salts of the quaternary ammonium compounds of Zhang. These salts are neither compounds of general formula 1a of the present application nor organo-sulfur compounds as described in col. 2, line 52 of Zhang. Nor are they alleged to be combinable with said compounds. More importantly, ***the compounds are not active materials***. These carbon-carbon bond containing compounds are the counter ions for the quaternary ammonium cationic polymers of Zhang.

The passage in col. 11, lines 15-20 discusses polymeric electroactive sulfur-containing materials. Thus, the passage is not discussing single compounds such as those of general formula (1a) or compounds such as those described in col. 2, line 52. The Examiner appears to be merely pointing to any compounds in the disclosure to try to prove her point without any indication of what the compounds are used for or how they related to the organo-sulfur compounds of col. 2, line 52. As such, the Examiner has indeed failed to show that Zhang teaches or suggests the use of a sulfur containing compounds such as that of general formula (1a) in the battery of Zhang.

The Examiner states that the "Zhang reference broadly teaches an electroactive carbon and sulfur containing cathode material (col. 10, lines 32-50) in rechargeable batteries".

However, as the Applicants have previously demonstrated, Zhang teaches against the use of the compound of general formula (1a) as an active material in batteries. Zhang teaches an electrochemical cell which uses an electroactive polysulfide-containing material of the formula -S_m-, where m is an integer from 3 to 10 and a cationic polymer comprising quaternary ammonium salt groups. The polysulfide material contains only sulfur-sulfur single bonds. Zhang further discloses, in col. 11, lines 21-30 that the polymeric electroactive sulfur-containing materials typically have **greater than 50wt% of sulfur, particularly greater than 86 wt%.** Thus, compounds, such as organo-sulfur compounds having lower than 50% sulfur by weight are not useful in the Zhang electrochemical cell.

In fact as previously stated, Zhang describes that ***"the organo-sulfur materials typically contain less than 50 weight percent of sulfur...so they have a much lower energy density or specific capacity than elemental sulfur***" (see, col. 2, line 63- col. 3, line 14 of Zhang). Thus, even if the "organo-sulfur materials" indicated by the Examiner did represent the compound of general formula (1a) of the present disclosure, Zhang clearly teaches away from the use of any "organo-sulfur material" having less than 50% by weight of sulfur, which the compound of general formula (1a) has.

Moreover, Zhang discloses in col. 10, lines 9-13, the use of an electrode material in which the electrochemical activity (electrode reaction) involve the formation and breaking of S-S covalent bonds. In contrast, in the present disclosure, the compound of general formula (1a) contains no sulfur-sulfur bonds. As such, one skilled in the art would not expect to derive any energy in the manner described in Zhang from any type of compound not having S-S bonds. Rather, the redox reaction of the compound of formula (1a) is based on the transfer of the electrons in the π-electron conjugation portion. As a result of this difference, very little

structural change of the active material occurs and as such, the diffusion of the active material out of the electrode is inhibited. This allows for improved cycle characteristics, a feature to which Zhang is silent.

Furthermore, the compound (1a) of the present disclosure has many differences than that of the TTF molecule disclosed in Carlier. As is well known in the art, the feasibility of application of a material as an active material for use in a secondary battery should be examined not only in terms of the redox reaction of the material in the electrolyte, but also in terms of the reversibility of reaction (charge/discharge cycle characteristics), the stability of the material with respect to the electrolyte, and the stability of the material within the potential range of the electrode. For example, Carlier discloses the redox behavior of the TTF molecule while being dissolved in acetonitrile, which is significantly different than the reaction mechanism used in secondary batteries. The electrode active material should be in an undissolved state for secondary batteries. In fact, if one followed the example of Carlier and used acetonitrile as the electrolyte for a lithium secondary battery comprising a negative electrode capable of charging and discharging lithium ions and a positive electrode including the compound (1a), the acetonitrile would decompose. This could result in battery leakage and explosion. As such, one skilled in the art would not be motivated to use the TTF molecule shown in Carlier in the battery of Zhang based on the disclosures of both references.

As is well known in patent law, if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). As Zhang describes how a compound as disclosed in Carlier would render the battery of Zhang inoperable for its intended purpose, there is no suggestion or motivation to

make the proposed combination of Zhang with Carlier. Accordingly, Applicants respectfully submit that the § 103 rejection of claim 32 over Zhang and Carlier is improper.

(2) Claim 22 is not obvious under 35 U.S.C. § 103(a) over Zhang in view of Carlier.

Claim 22 was rejected under 35 U.S.C. § 103(a) for obviousness predicated upon Zhang et al. (USP No. 6,110,619) ("Zhang") in view of Carlier et al. (Publication Electrochimica Acta). Applicants respectfully traverse this rejection for at least the following reasons.

Claim 22 recites a battery in which compound is a polymer compound having more than one structure represented by the general formula (1a).

Zhang and Carlier fail to disclose a polymer compound as recited in claim 22 of the instant application. Nor do Zhang or Carlier disclose or suggest that using the foregoing polymer compound as the active material advantageously makes it possible to effectively inhibit the elusion of the active material into the electrolyte and thus improve the cycle characteristics (see, page 13, lines 14-18 of the specification). As such, it is clear that claim 22 is allowable over the cited prior art.

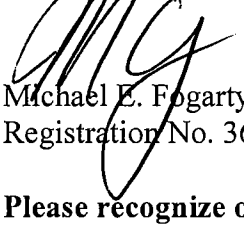
Conclusion

In view of the above arguments and those set forth in the Appeal Brief, Appellant respectfully submits that the Examiner's rejections under 35 U.S.C. § 103 are not legally viable. Appellant, therefore, respectfully solicits the Honorable Board to reverse the Examiner's rejections of claims 22, 25, 28, 32, 35, 38, 41, 44, 47, 50 and 53 under 35 U.S.C. § 103(a) for obviousness predicated upon Zhang et al. (USP No. 6,110,619) ("Zhang") in view of Carlier et al. (Publication Electrochimica Acta).

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP



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